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# *The* CAROLINA ENGINEER

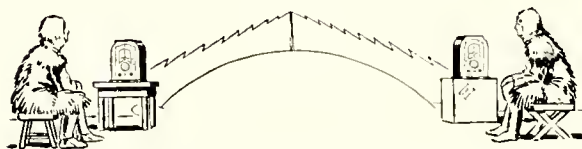
SCHOOL OF ENGINEERING  
UNIVERSITY OF NORTH CAROLINA

VOLUME III - - - NUMBER 1



NOVEMBER, 1934

# G-E Campus News



## TWO POLES IN ONE

Radio entertainment and "airmail" have been sent to the Antarctic through General Electric's short-wave station W2XAF, ever since Rear Admiral Byrd arrived there last year. Recently, in conjunction with a Byrd program, another was sent out to Rockwell Kent and his son in the Arctic region—thus linking simultaneously Americans who are, in the matter of latitude, farthest apart. Governor McNutt of Indiana and other prominent Hoosiers spoke to the Byrd Expedition from Indianapolis in a program sponsored by the *Indianapolis Star*. Immediately afterward, the Coffee House Club, an organization of artists and writers to which Rockwell Kent belongs, sent music and greetings from New York to him on the island of Upekjent, just off the coast of Greenland, 600 miles within the Arctic circle. Features of this program were special greetings from Mrs. Kent and her daughter, and a talk in the Eskimo language by Vilhjalmur Steffansson, Arctic explorer, for the benefit of the natives. Both programs were broadcast over a coast-to-coast NBC network as well as by short waves.



## GOOD-BYE, SMOKESTACK

For many years, the old central heating plant at Mt. Holyoke College in Massachusetts, with its tall, unsightly smokestack, barred the way to certain necessary improvements and landscape developments on the campus. This summer the old boilers and the smokestack were torn down. In one of the buildings of the old plant stand 120 General Electric oil furnaces arranged in circular groups of five. Fifty-two more G-E oil furnaces are installed in the smaller or more isolated buildings of the campus, operating singly, in pairs, and, in one instance, in a battery of 10. In the central plant, only as many groups of

furnaces will operate as are necessary to maintain the required steam pressure. The remainder will be shut down, avoiding stand-by losses. The individual furnaces and small groups in distant buildings permit the abandonment of some of the longer runs in the underground steam-distribution network. The high efficiency of the system is expected to produce savings which will pay for the installation in five to seven years. In addition, as a result of the more careful regulation of temperature, it is expected that health conditions at the college will be considerably improved.

The main plans for the system were drawn up by C. W. Colby, consulting engineer. D. W. McLenegan, Wisconsin, '21, assistant engineer of the Air Conditioning Department; W. O. Lum, and H. R. Crago, Penn State, '18, both of the same department, handled engineering details for General Electric.



## FLYING POWER PLANT

Gold was discovered in 1925 along the Bulola River in New Guinea, an island just north of Australia. Prospectors worked the richer veins by hand methods, and packed their "take" on the backs of natives through 40 miles of cannibal-infested and nearly impassable jungles to Lae on the coast. After the best veins had been worked out, it became apparent that placer operations on a large scale would pay if the necessary dredges and other machinery could be brought to the location. Land transportation was impossible, so a plane was sent in. The pilot found a spot to land, and a flying field was cleared off.

Four 875-kv-a. General Electric waterwheel generators were among the equipment ordered. When they arrived at Lae, they were transferred to huge all-metal Junkers freight planes and flown to the location piece by piece. The largest single pieces had a net weight of 6545 pounds. As the load limit of the planes is 7000 pounds, it was a tight squeeze. D. B. Gearhart, Iowa State, '27, of International General Electric, Inc., handled the order for the Company.

96-83DH

# GENERAL ELECTRIC

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*Faculty Advisor*

# THE CAROLINA ENGINEER

*The Professional Journal of the School of Engineering*

UNIVERSITY OF NORTH CAROLINA

VOLUME III

NOVEMBER, 1934

NUMBER 1

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*Memorial Hall*



## Soil Erosion Control

by TOM GORDY

*EDITOR'S NOTE: Mr. Gordy spent the past summer working for the Soil Erosion Service at High Point, N. C.*

Soil erosion control is the saving of remaining good land, or the retaining of land having some top soil. Soil erosion is the farmers greatest menace, this being clearly demonstrated by the worn-out fields, gullies, thickly muddied streams, and poor crops that are on his farm. The worn-out fields are results of poor, if any, crop rotation; the gullies are results of neglected waterways and drains; the muddied streams are results of the washing off of valuable top soil. Many farmers today are tilling subsoil, not because they do not know better, but because it is their only means of existence. It is the object of soil erosion control to abolish such unfavorable and bankrupting conditions that do exist.

For effective control, the co-operation of the farmer is required; his co-operation with the support of the United States Department of the Interior will find for him a comfortable living. He must give as much of his time, labor, and equipment to the erosion control as he can, and also keep up the control constructions that are built on his land.

Before actual control operations begin, a survey of the farm is made. In this survey the property lines are located, acreage is calculated, and the general lay of the farm is noted. After the size and lay of the farm have been determined, the type of farming is next considered; some of these types are dairying, potato growing, tobacco growing, and trucking. Each type has its needs that must be fulfilled, and it is with these needs in mind that a farming program is worked out. To begin the program a set of farm notes are compiled. In these notes are included the size of the family, the acreage of each tillable field, the acreage of forest land, the acreage of pasture land, and the cattle on the farm. The soil in each field under cultivation is first tested; and later, pasture and wooded lands. These tests are made by removing samples of the soil at various locations and depths with hand augers.

Knowing the types of soil on the entire farm, the erosion control staff can determine the crops suitable for various fields. If a field is level, that is having a slope of 2 feet or less in 100 feet,

the problem of washing is placed as a minor problem. If, however, the slope is 4 or 5 feet in 100 feet, it is possible that the land may be put out of cultivation and into forest. The type of soil determines to a large degree the washing characteristics of the field, as well as the cropping if the land is kept under cultivation. If the soil and slope are such that cultivation is continued, some method of saving topsoil and preventing washing must be obtained.

This method is usually terracing. Terraces generally follow the contours of the field as closely as possible, and the spacing between them is determined by the slope, type of soil, and change of slope. The average terrace is from 16 to 18 feet wide including crest and recess for draining, and is 18 inches from the top of the crest to the bottom of the drainway. The slope of the drainway, and necessarily the terrace, is from zero to 4 or 5 feet in every 300 feet of terracing, this being determined by the length of the terrace and the location of outlets. If a terrace has a small slope and is very long, it is likely to fail when a heavy rain comes, and it is with this in mind that terraces in general are laid out.

After being laid out in direction, the terraces may be built by hand, by team and scoop, or by a tractor-terracer. Since the average farmer's time is occupied with his teams, the tractor-terracer is usually used. After being thrown up by the terracing scrape, the terraces are filled in or "patched" by men with shovels.

After the terraces are built, outlets must be constructed to carry off the water that is collected during rains. If the field joins a heavily-sodded area or brushland and the sodded area is practically level, the outlet may be directly into this area. If, however, this is not the case and no wash-resistant area is near, a check outlet must be built of rock, concrete, logs, or any material that is wash-resistant. The purpose of the outlet check is to decrease the velocity of the washoff, thus allowing the suspended soil to settle out, and later be thrown back on the terraced field. The washoff enters the check over a bed of wash-resistant material and falls into a box built of the same resistant material. When the water hits the bottom of this box, the kinetic

energy is reduced and, as the box becomes full, a slow flowing stream of water is released over the box edge, which acts as a weir. It is the duty of the farmer to clean out this check after each rain, and to return the cleanings to the terraced field. Because there are usually several terraces on one field, it is necessary that checks be built between terrace outlets to decrease the velocity of the main drains. Since almost all the soil is removed in the checks, the final washoff is practically clear water and may be drained into streams or road ditches. The washoff carried by the terracing system varies with the crop: washoff from sloping land sowed in lespedeza, a thick growing crop, is from 1200 to 1500 per cent less than from bare ground, and from 500 to 1,000 per cent less than where a cultivated crop such as tobacco or corn is grown.

The terracing system not only keeps the farmer's soil on his farm, but it also prevents rivers from being filled with mud and silt. Since many cities take their water supply from streams and rivers, it is a vital problem to keep their supply lakes free from mud and silt.

So far only land under cultivation has been considered, and no control work has been applied to the other land on the farm. As mentioned before, there is pasture land on almost every farm. If the control service deems it advisable, some pasture land may be turned into cultivation or, vice versa. In some cases land is taken from cultivation and put directly into forest, because cultivation on that land has been an increasing loss each year. However, it is a usual procedure to put fields unsuitable for cultivation into pasture. In the pasture a sod or covering of some kind is necessary, and it is the job of the erosion control service to determine the grass that is best suited for the certain pasture. After the pasture has been grassed, cattle should be kept off until a good stand is over the ground, and, after being planted, rotation of grazing will help the pasture maintain its sod and grass. Although steady grazing is possible on a pasture, a better stand of grass is obtained with rotation of grazing. In meadows a grass or similar covering is also selected.

On lands that are not suitable for cultivation or pasture, forestry can probably be successfully started. Forestry does not mean the sawing, hauling, and selling of timber, but it means the growing of a timber crop for future harvesting. The kinds of trees suited for a certain piece of ground can usually be determined by investigating the surrounding territory. Trees may be either hardwoods or pine. In the hardwood classes are the black oak, white oak, Southern red oak, willow oak, black-jack oak, and the maples; in the pine

class, the short leaf pine, Virginia pine, and loblolly pine. Around damp places the willow, sycamore, and birch may be found. After trees are planted it is the farmer's job to watch his forests and keep them free from beetles and other harmful insects. As the trees grow he should keep all broken limbs off the ground as these dead limbs are a good place for insects to breed. When storms break down limbs or trees, the farmer should clear them up as soon as possible, thus allowing the less injured trees to recover and grow. Although a timber crop is very slow in maturing, the profit of the crop as a whole is as much, if not more, than a cultivated crop. Timber does not require as much labor as do cultivated crops. Therefore, considering the timber crop on a long-term basis, it is as profitable as any other farm crop. However, besides being profitable it is excellent for erosion control. The leaves, moss, and litter that always are in timber land do not allow a swift flow of water, and thus less washing occurs. Since the velocity of the washoff is decreased, more water is taken up by the ground, decreasing the amount of water going into the streams and rivers, and thus reducing the flooding of lowgrounds after or during a heavy rain. When the farmer gets ready to harvest his crop he may put the better and larger cuts into commercial timber, the smaller pines and poplars into pulpwood, and the injured or broken timber into fuel wood.

So far only erosion control methods on the farm have been discussed. However, all rain and surface water is not handled by erosion control devices, and some washoff flows directly to rivers or lakes. As this water enters the river, some erosion takes place, and what solid material goes in the water helps to fill the river or lake further down the waterway. As yet no set method of water edge erosion control has been determined, but experimental methods have been used where possible. The most satisfactory of these methods is the planting of water-thriving plants or trees along the water edge, the distance from the edge being such that high water will not wash out the smaller plants. The plants best suited for this are young willow and alder, planted about one foot apart. If one row of plants is not sufficient to control erosion, a second or even a third row may be set, the distance between rows being determined by the conditions under which the plants are to grow.

By using erosion control methods on the fields, in the forests, and on the water edges, the farmer is able to keep his soil on his land, grow better crops, keep his farm up more easily, and earn a comfortable living.



# The Engineering and Water Resources Division

by W. C. MORRISON

Tucked away in an inconspicuous corner of the basement of Phillips Hall is a small group of offices housing the Division of Water Resources and Engineering of the North Carolina Department of Conservation and Development. Regardless of its location, this division from the engineer's viewpoint is probably the most important one of the six divisions comprising the Department of Conservation and Development. Its activities consist of stream gaging, underground water investigations, chemical water analysis, hydrologic studies, water power developments, and other important factors which are important to the engineers in the field of water supply engineering.

In the summer of 1920, Thordike Saville, professor of civil engineering at the University, was appointed by the state to make surveys of the undeveloped water powers of North Carolina. This was the beginning of the present division. For the first few years up until

1925, the activities of the bureau were almost wholly confined to stream gaging and water power developments. However, as the work of

the division became noticed throughout the state, various requests for miscellaneous information were received. In order to comply with these requests, the members of the bureau gradually expanded the scope of their research and investigation as far as funds would permit. Their field was so greatly enlarged that by 1927 the projects which were being investigated included mapping and surveying, stream sanitation, hydraulic engineering, and other water studies of a similar nature. These activities have been continued up to the present date in so far as it has been possible with the small amount of funds allotted to the division by the state.

It might be well to consider the various activities of the department and their relation to the welfare of the communities throughout the state. The fun-

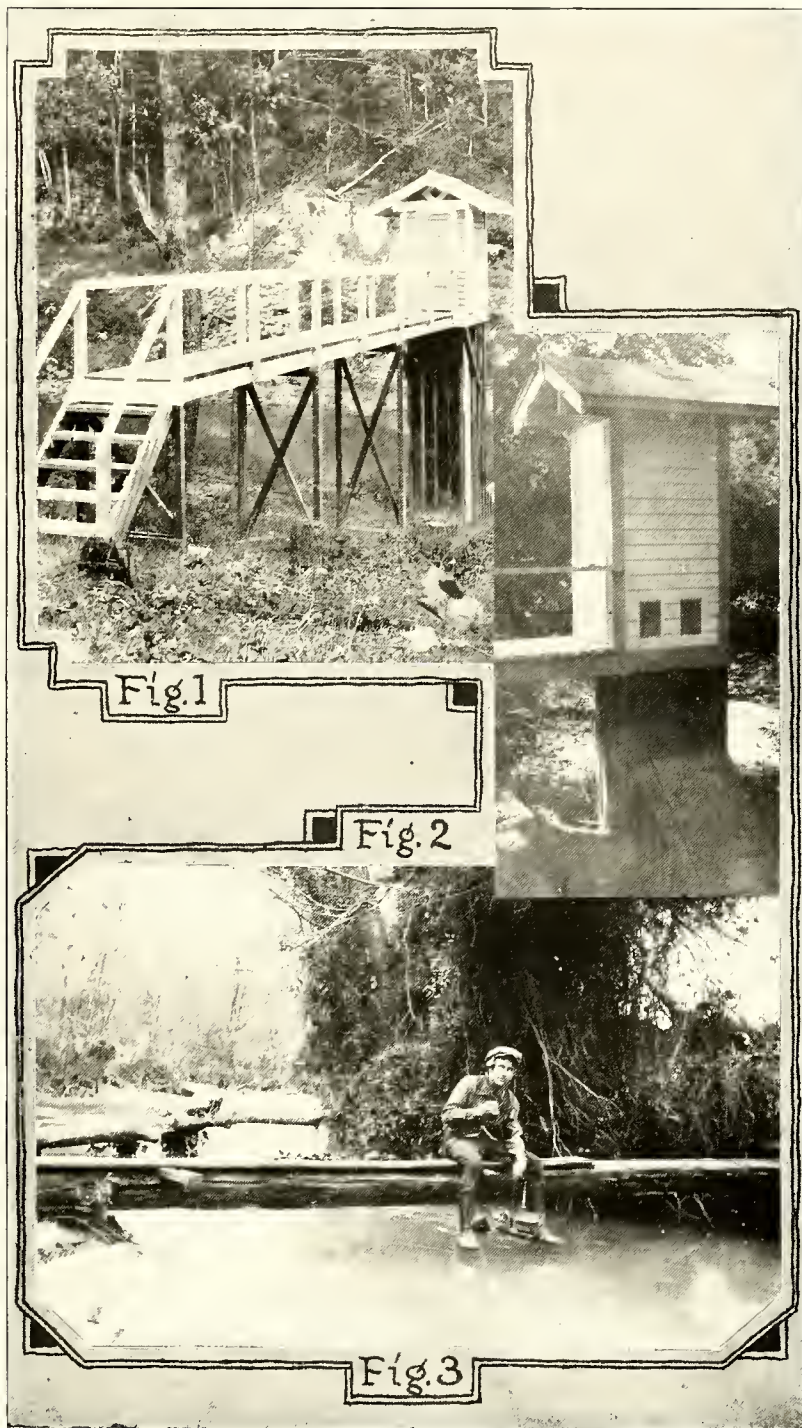


FIGURE 1—Shelter house and stilling well of stream gaging station on Flat River in Durham County.

FIGURE 2—Stream gaging station on South Buffalo Creek operated in co-operation with the city of Greensboro.

FIGURE 3—Engineer resting on footlog after measuring flow of the stream with the current meter shown suspended.



damental activity of the bureau is naturally stream gaging, and the interpretation of the stream flow data in its correct sense. The variations in stream flow over a period of a day, a month, a year, or a series of years are of utmost importance in the proper allocation of any project in the field of water supply engineering. For the most accurate picture of stream flow of a river, a record of a period of at least thirty years is advisable. Up to the present time records exceeding thirty years in length have only been collected at six stations in the state. All these records were made on streams which are fairly large. At the present there are 86 stream gaging stations throughout the state of which number 82 are operated automatically. The majority of the stations have been in operation for only a comparatively short period of time, and as yet can not really furnish complete records of stream flow data for the streams on which they are located. A large amount of this sudden expansion of stream gaging was made possible through the assistance of the United States Geological Survey and the United States Army Engineers who contributed a large amount of the funds necessary for the construction of the stations. Through their aid 78 were constructed and put into operation since 1920. Present plans for further expansion have been somewhat hampered by the reduction of funds by both the state and federal governments.

However construction has not wholly ceased as economic measures with the help of the state highway commission have made possible the installation of a new type of reinforced concrete shelter gaging station. These have been constructed at small cost in the new bridge piers or abutments near High Point, Lillington, and Tarboro, and have enabled the department to continue its program to some extent.

The division also compiles and publishes each year a report of the power situation in the state. This activity is of immense value as it enables the public to keep up with the progress being made in water power development in the region of North Carolina and the surrounding states. By this procedure, a clear picture of public utility power in this section is presented in pamphlet form. However this information is not so easily obtained as one may think. The division can submit forms to public utility companies, requesting them to report on their power activities. The companies which have filled out these blanks and returned them have done so of their own volition as the division has no power to compel them to complete the forms. This shows that it is fairly difficult for the bureau to secure the true facts about the power situation. To facilitate the di-

vision's work, it has been suggested that the state grant some department, either the Water Resources and Engineering Division or another one, the authority to require such reports from the public utilities companies.

The members of the bureau not only collect data on such hydrologic occurrences as rainfall, stream flow, evaporation, and the silting in power and water supply reservoirs, but also try to interpret and make these data readily available to the engineers of this state. The silting in power and water supply reservoirs studies and the evaporation studies are undertaken by the division itself while the stream flow and rainfall studies are made in cooperation with the U. S. Geological Survey and the U. S. Weather Bureau.

Most important in the division's work in hydrologic studies is the supplying of estimates on stream flow at points in the state near which there are no gaging stations. These studies require a lot of work and time, but perform a beneficial service for the engineers requesting such information. Most recent in the division's work is the study of drought conditions and the forecasting of periods of minimum stream flow and rainfall in various sections of the state. This field has just recently been considered as an additional duty of the division, and will probably be continued as long as its work is received favorably by the engineering world. Although a larger amount of this work is in the experimental stage, forecasts which have been publicly announced by the bureau have worked out according to predictions.

The work of this division is not wholly concerned with the field of inland waterways. A considerable amount of time is being spent on studies of coastal changes along the long stretch of Atlantic seacoast. Observations of beach erosion have been made at Wrightsville Beach, Fort Macon, Fort Fisher, Carolina Beach, and Atlantic Beach. The data which have been obtained have been of great importance in the planning of protection works for the damaged sections. Both ground parties and aerial surveys were used in making these studies. Particular and intensive studies were made of the re-opening of New Inlet by the terrific storm in March, 1932. The work of this branch of the division has been hampered by the lack of engineering personnel, and thus has not been able to furnish the needed engineering assistance for coastal studies that it could do with the proper number of men.

The Water Resources and Engineering Division handles all complaints regarding alleged damage to fish life from sewage and industrial wastes. These complaints are numerous and very difficult to investigate as the small engineering per-

*(Continued on page nine)*



# The Floating Road

by JACK MCM. PRUDEN

In Camden County, North Carolina a most unusual piece of highway construction may be found—a floating road. “A floating road!” you may say, “I never heard of such a thing! That sounds like one of those Eastern North Carolina fish stories—maybe a product of Carl Goerch’s imagination.” Well, it may sound fishy to you, but it attracted the attention of the State Highway Commission and caused its members many a restless night.

To get from Elizabeth City over into Camden County it is necessary to cross the Pasquotank River. Just at the city limits the river makes a sharp bend, and at this bend a peninsular juts out from the Camden side, making the distance across the river shortest at this point. Because of this fact and because the shores further upstream are swampy, the bridge from Elizabeth City was located at this point. For a distance of 2½ miles, the road from the bridge up into Camden County passes over swampy lands, thick in vegetation. For years the road had to be rebuilt at frequent intervals, for it was continually sinking in and washing away because of the marshy nature of the land over which it was built.

In 1922 when this automotive age of ours began creeping up on us, it was found necessary to build some permanent type of road over the swamp; so the State began the construction of a concrete highway. Poles were cut from the nearby forests and hauled to the job. They were placed across the roadbed for the distance of the marsh, and a two to three-foot earth fill placed upon them. Shortly afterwards the fill was covered with a 6-in. reinforced-concrete pavement, 16-ft. in width.

The geological composition of the marsh is peat, and the water from the nearby river keeps it in a boggy condition. The bearing strength of the roadbed was so low that in the course of the next two or three years portions of the paving settled from two to three feet. These portions acted as catchment basins, and the water from the bog drained into them.

An attempt was made in 1925 to retard this sinking of the paving. Pilings were driven in on each edge of the lowest points of the road and notched. These pilings were tied and pulled together by the use of iron rods. Crushed slag was placed on top of the original paving thus anchored. This effort to save the road was not a success, however, as tidewater kept the slag-fill in a loose condition, and the pavement that was unanchored began to settle more.

The road was now covered with water most of the time, and at high tide water came up to the running board of cars traversing it. Automobile owners boasted when they made the trip across in second gear—even when they made it without getting stalled. Automobiles passing over the road had to proceed cautiously, zigzagging back and forth to feel out the course of the road. Hydrological bulletins were consulted before anyone dared to make the perilous journey. Because of its watery condition the highway became known as “The Floating Road.”



ROAD SUPPORTED BY TRESTLE

The excellent shooting to be found on Currituck Sound, the development of Dare County’s beach area, and the historical shrine on Roanoke Island were attracting more and more motorists to travel this road.

The highway engineers appointed to solve the problem, decided that the most permanent and economical thing to do was to abandon the original slab-concrete road altogether, and to build a trestle over the entire length of the marsh.

In 1929 the construction was begun. Piles of creosoted pine to support the bents of the trestle were penetrated to an average depth of about sixty feet below the marsh surface. These piles were capped with 18-in. concrete pipe and filled with Inco-cement concrete. The caps are 12 in. by 14 in. by 22 ft. Creosoted pine joists 4 in. by 14 in. by 18 ft. were used to connect the bents. The flooring of the 20-ft. roadway, supported by the bents 18 ft. apart, was constructed of 3 in. by 4 in. creosoted pine upon which was laid a 1½-in. Amiesite wearing surface.

This final attempt to insure a road that will be out of reach of the highest tidewater seems to be very successful, and present-day traffic experiences none of the difficulties that were encountered on the old “Floating Road.”

# New Faculty Members

Dr. Arthur E. Ruark, the new head of the physics department, was born in Washington, D. C., and attended the undergraduate and graduate



school at Johns Hopkins University in Baltimore, receiving a degree of Ph. D. in 1924. On first entering the University, Dr. Ruark studied civil engineering, but at the end of two years he changed to the School of Applied Science and the study of physics.

His work, which with one exception has kept him in the

field of physics, has been greatly varied. In 1921 to 1926 he worked on atomic structure at the Bureau of Standards in Washington. Then he spent one year as assistant professor of physics at the Sheffield Scientific School at Yale University. He left the teaching of physics at Yale to become associated with the Mellon Institute of Industrial Research in Pittsburgh, Pa., where he did research for the Gulf Oil Corporation on oil production. In 1930, he became professor of physics at the University of Pittsburgh, conducting research at the same time on radioactivity, the structure of the atomic nucleus, and cosmic rays.

Dr. Ruark, assisted by six members of the University of Pittsburgh teaching staff, wrote *Modern Atomic Physics*. With the assistance of Harold C. Urey, professor of chemistry at Columbia University, he wrote *Atoms, Molecules, and Quanta*. Dr. Ruark is a member of the board of editors of three periodicals, *Physical Review*, *Review of Scientific Instruments*, and *Philosophy of Science*.

During the fall quarter Dr. Ruark is teaching an advanced course in wave mechanics. Besides his duties as head of the department, he is also conducting research in the field of artificial radioactivity along the lines as that at the Cavendish laboratories.

Dr. C. W. Borgmann, the new assistant professor of chemical engineering, received the degree of B.S. in Chemical Engineering at the University of Colorado in 1927. Following his graduation, he was employed for four years in the chemical research laboratories of the Bell Telephone Company, studying the corrosion and protection of metals.



In 1931 he entered the graduate school at the University of Cambridge in England. After the end of two year's work there, he was awarded the American-Scandinavian Fellowship which enabled him to study for two years at the Technical High School in Trondheim, Norway and at the Metallographical Institute in Stockholm, Sweden. Returning to Cambridge University after the conclusion of his studies on the continent, he was awarded the degree of Ph.D. in Chemical Engineering in June, 1934.

Dr. Borgmann came to the University of North Carolina in September, 1934 to take up his duties in the department of chemical engineering.

John C. Geyer, instructor in sanitary and hydraulic engineering comes from Neosho, Mo. After receiving the degree of B.S. in Civil Engineering at the University of Michigan, Mr. Geyer entered the Harvard Engineering School at Cambridge, Massachusetts. There, as assistant instructor, he taught and studied for a period of three years, at the end of which he was awarded the degree of A.M. in Civil Engineering. During his stay at Harvard he served as assistant to Professor G. M. Fair.



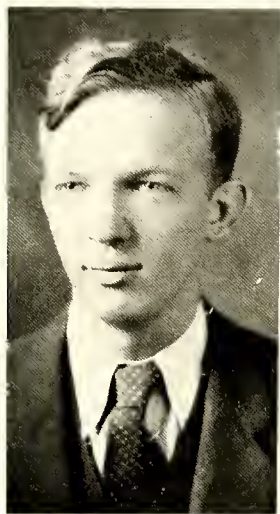
He left Harvard to become associated with Fuller and Everett, consulting engineers, of New York City, where he worked as designer and draftsman.

In addition to his duties as instructor in sanitary and hydraulic engineering here, Mr. Geyer is assisting M. S. Campbell, of the Textile Foun-



dation Research, in the study of the disposition of textile wastes.

John Allen McLean, instructor in mechanical engineering. Mr. McLean was born in Maxton, North Carolina, and attended the University of North Carolina, receiving the degree of B.S. in Mechanical Engineering in 1933.



After his graduation, Mr. McLean was employed as assistant tabulator by the American Cotton Co-operative Association in Charlotte, North Carolina. Later he was employed as county engineer for Mecklenburg County, North Carolina and as assistant project supervisor of C.W.A. in Mecklenburg County.

He returned to the University at the beginning of the 1934-35 school year to teach aeronautics, steam, and mechanics in the department of mechanical engineering.

James Robert Marvin, instructor in general engineering, was born in Montgomery, Alabama. He entered the University of North Carolina in 1929, and received the degree of B.S. in Electrical Engineering in 1933. He was employed by R. H. Bouligny, electrical contractor, of Charlotte, North Carolina for two quarters of his junior year, fulfilling the University requirements for co-operative work.



He was awarded the teaching fellowship in electrical engineering at the University for the 1933-34 school year. In addition to his teaching, he devoted himself to a study of the calculation of third harmonics in transformer networks, transient circuits, and advanced transmission engineering.

As instructor in general engineering, Mr. Marvin teaches sophomore and junior mechanics. He was recently married to Miss Marjorie Boring of Chapel Hill.

Dr. E. C. Markham, assistant professor of chemistry. He attended Trinity College in Durham, North Carolina, receiving the degree of A.B. in Chemistry there in 1923.



Following his graduation at Trinity, he entered the graduate school at the University of Virginia, and received the degree of Ph.D. in Chemistry in 1927. He served as assistant professor of chemistry at the University of Virginia from 1927 to 1930 and as research associate there from 1930 to 1933.

In 1933 he became instructor of chemistry at the University of Delaware, resigning in 1934 to become assistant professor of chemistry at the University of North Carolina.

Dr. Markham's research as a graduate student and as research associate at the University of Virginia consisted of a study of the absorption by solids of gases at high pressures.

## THE ENGINEERING AND WATER RESOURCES DIVISION

*(Continued from page six)*

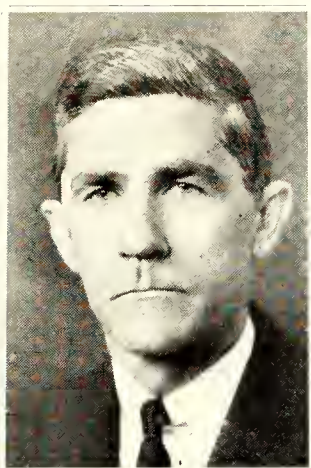
sonnel cannot cope satisfactorily with them all. In any case, the water is tested, and if found to contain an objectionable amount of pollution, a complaint is submitted to the factories or mills responsible for the condition of the stream. Generally the plant will remedy the situation as soon as the request is received from the division. Again, however, the division can only act as an investigating body having no special power to compel the offending companies to refrain from polluting the water.

New industries such as the rayon, tanning, paper, and pulp industries are attracted to the South for the opening of new plants because of the attractive advantages of the location. Always before they establish a new plant, however, they desire to know the quality of the water they will have to use. They desire to know the turbidity, coloring, and hardness of the water. At present little study has been made along this line but the bureau would like to add this new field to its activities.

All the aforementioned activities of the Division of Water Resources and Engineering have their share in the welfare of the municipalities and the industries of the state, and North Carolina has taken the lead in that it is the only Southern state which has developed an engineering agency whose duty it is to investigate all phases and branches of its water resources.

## ALUMNI NOTES

Professor T. F. Hickerson, an alumnus of the University and head of the department of civil engineering, has recently published a new book, *Structural Frameworks*. This book has been



well received throughout the country and has been reviewed by several of the prominent engineering journals. An abstract of a review by Mr. Robins Fleming, of the American Bridge Company, for the September 17, 1934 *Engineering News-Record* is as follows:

"Professor Hickerson has made available a contribution to the

literature of rigid-frame structures. It is original, novel and practicable of application. Part I is devoted to members with constant moment of inertia, and Part II to members with variable moments of inertia. In Appendix A there are 50 tables. Appendix B is a treatment (not found elsewhere) of bending and direct stress. Appendix C is an analysis of approximate methods of tall building frames.

"Bending moments in continuous beams or other statically indeterminate structures are determined in terms of the "fixation factors" of the several members at points of support. The formulas are built up from the fundamental equations of the slope-deflection theory . . . The author in this portion of his book has concrete structures specially in mind . . .

"Tables throughout the book, 69 in all, representing an enormous amount of work, are given to expedite calculation. The numerical solutions of illustrative examples are a great help in understanding the application of formulas. Fixed-end moments are distributed by a single cycle of operations . . .

"The book of Professor Hickerson should be in the possession of every instructor of structural engineering. A knowledge of its contents is necessary for him to be fully equipped for teaching the determination of stresses in rigid frames. The book is recommended to the practicing engineer for study and consideration. The extent to which he will adopt its methods depends upon the personal equation."

An alumnus of this school who has distinguished himself in the waterways field is Mr. Ernest Graves, a member of the Mississippi River Commission appointed five years ago. Upon finishing here, he went to West Point. In his senior year there he was football captain and after graduation acted as head football coach. In 1917 Mr. Graves went to Europe in the A. E. F., and while there he received the Distinguished Service Medal. In 1921 he retired from the army. President Hoover appointed Mr. Graves as a member of the Mississippi River Commission in 1929. Two years later he was elected Chairman of the Interoceanic Canal Board which position he holds at the present.

Arthur S. Chase, a member of the class of 1924 is now located in Spartanburg, S. C. working for the United States Geodetic Survey. For a while after finishing here, he taught engineering at Southern Methodist University in Texas.

T. C. Evans, Jr. of Charlotte, who graduated in 1933 in electrical engineering, is working on the national power survey being conducted by the Federal Power Commission.

Leonard C. Suprenant, also a member of the 1933 class, was at Carnegie Institute of Technology on a fellowship last year and is now a chemical engineer for the Goodrich Rubber Co.

Four of last year's civil engineering graduates are located in High Point, N. C. as engineers for the Soil Erosion Project. They are Sid Franklin, Dick Dailey, Simon Krock, and "Mac" Isley.

Paul Hayes, mechanical '34, is in Greensboro, working for the Standard Oil Company of N. J.

"Herb" Stewart, an electrical graduate of last year and former manager of the CAROLINA ENGINEER, is in Washington, D. C., working with the Federal Government. "Herb" and wife were down for the Carolina-Duke game.

C. M. Sawyer, a member of last year's Chemical graduating class, is in Winston-Salem. He is connected with R. J. Reynolds Tobacco Co.

James Lewis of '26 and a civil, is in Knoxville with the TVA. Before he started on this job, he was with a construction company in Virginia.

E. L. Kendrick, another mechanical graduate of last year, is now with the Eastman Kodak Co. in Rochester, N. Y., working in the purchasing department.

George Gorham '33, the first editor of the CAROLINA ENGINEER and a member of both Phi Beta Kappa and Tau Beta Pi, is working in a fertilizer plant in his home town, Rocky Mount, N. C.



# Who Said "It Will Not Pay?"

by DAN FIELD

Many of the larger power concerns of this country have discouraged towns and industries from erecting power plants of their own by declaring such plants unprofitable. The majority of the towns and industries accepted this statement, but a few of the larger industrial concerns started investigations of their own to determine whether or not the power companies were right.

One of these industries is the Proximity Manufacturing Company of Greensboro, N. C. This concern controls four mills, situated reasonably close to each other, which produce cotton textile fabrics. The four mills are White Oak and Proximity, which together constitute the largest denim mill in the world, and Revolution and the Print Works, which together produce cloths suitable for bed spreads and outings.

The manufacture of these fabrics calls for large quantities of steam at low pressures for drying the cloth and warp. This steam is known as processing steam. The quantities of processing steam needed required the installation of large boilers at the two denim mills, White Oak and Proximity, and smaller boilers at Revolution and the Print Works. Since the boilers were of the high pressure type, the company installed a 2500-kw turbo-generator at White Oak, a 100-kw turbo-generator at Proximity, and a 750-kw turbo-generator at the Print Works. The steam was put into these turbines at high pressures and bled off at a pressure suitable for use in processing and heating.

Although these generators supplied some electrical power to run the mills, the company still had to buy all of the power for the Revolution mill and the majority of power for the other mills. The total power consumed by the mills in a year's time was 34,500,000 kw-hrs, the majority of which was bought from a utility company.

In 1928 the mill company installed new genera-

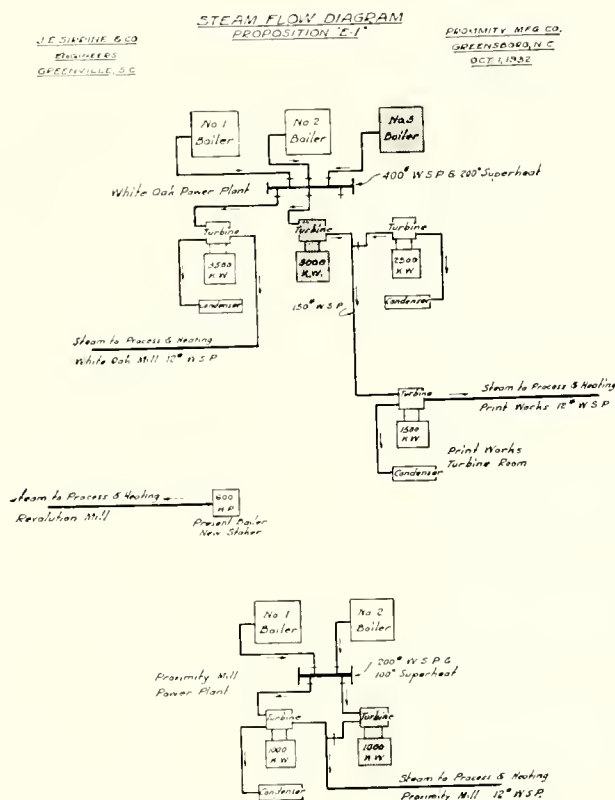
tors and boilers as the demand for both processing steam and power had increased considerably since the last installation, which had been made shortly after the war. The boiler room at the White Oak mill was greatly improved by the addition of two 450-lb. combustion-tube Babcock & Wilcox boilers equipped with superheaters to give 200 degrees superheat, and with water cooled fire walls and hydraulic ash removers. These two boilers were fired by impact pulverizers capable of supplying 500 lb. of coal per hour to the fires. A 3500-kw double-extraction turbo-generator was also installed at White Oak, and a 1500-kw single-extraction turbo-generator was installed at the Print Works. The double-extraction turbine at

White Oak was capable of giving off steam at pressures of 150 lb. and 12 lb. The steam at 150 lb. was piped 2100 ft. to run the turbine at the Print Works which was capable of giving off steam at 12 lb. pressure. In both cases the steam drawn off at 12 lb. pressure was used for processing the goods and heating the mills. The steam which was bled off of the 3500-kw turbine at 150 lb. could also be used to run the 2500 kw. generator, or this generator could be run from the main steam line by use of a reduction valve to reduce the steam pressure from 450 lb. to 150 lb.

With this new addition of power three of the mills, Proximity, White Oak, and the Print Works, were connected by a transmission line so that power which could not be used at White Oak or the Print Works could be transmitted to Proximity for use there.

This 1928 installation paid for itself in five years, and was very definite proof to the company that the installation of turbo-generators for power does pay in the cotton textile industry.

The increase in power derived from the 1928 project still left the Revolution mill buying all of its power, and the other mills, as a unit, buy-



—Cut Courtesy Southern Power Journal

ing 1000 kw. In 1932 the company considered the installation of enough power equipment to almost completely supply the four mills with power, the installation to supply 11,600 kw for normal operation with an additional load of 2000 kw at night. This new equipment also was to supply an abundant supply of processing steam amounting to 223,250 lb. per normal day of operation. The adopted installation plan assured the company a net return of 32% on the investment.

The plan called for the addition of a large 450-lb. boiler at White Oak and also a new 3000-kw bleeder turbo-generator which was to supply steam at 150 lb. pressure for the 2500-kw and the 1500-kw generations. A new 1000-kw generator, installed at Proximity, was designed to run at 225 lb. pressure and 100 degrees superheat and to give off processing steam at 12 lb. pressure.

All of the furnaces are equipped with automatic stokers and pulverizers, and are supplied with specially treated water to prevent the formation of boiler scale. In the Proximity mill the two boilers supplying the two 1000-kw generators with steam are operated by one man. The coal for this plant, which is bought in powdered form from either the Virginia or West Virginia fields, is stored under a shed to keep it dry. From the shed the coal is hoisted to a tank high above the boilers from which it slides through a pipe to the distributing funnel. This funnel is arranged on a sliding rail so that it can be moved across the front of the furnaces. From the funnel the coal is poured into hoppers on the front of each furnace, and from these hoppers it is fed into the furnaces by automatic stokers. The funnel on the sliding rail is so arranged that the coal which slides into it from the tank above the boilers can be weighed. The weight of each amount of coal put into the hoppers is recorded on a card, and these cards are filed every day. In this manner the company can keep a close record of the amount of coal burned, and the power which is obtained from the combustion of the fuel. Coal analyses are run to determine the heating value of the coal. The furnaces are also provided with hydraulic ash rejectors which dump the ashes into a car on rails that is rolled under the furnace. This car can be hoisted by a cable to an ash receptacle where the ashes are dumped ready for removal by trucks.

The power output of each mill is watched carefully, and charts are drawn every day giving in detail the amount of coal consumed, the amount of steam used, and the power output of each plant. In this way a very close check of the ef-

ficiency of the system is maintained, and any loss of power is soon corrected.

With this great power improvement program the Proximity Manufacturing Company can operate almost entirely independent of the power utility and is saving money by generating its own power together with its processing steam.

The company has also found that with its own power system it has had much less trouble with machinery operation throughout the mills and also with the replacement of light bulbs than it had when the mills ran on utility power. Many of the machines are controlled by automatic tripping devices which are very sensitive to voltage changes. When using the power from the utility company it often happened that a whole section of the mill would be shut down by some sudden change in the line voltage which would trip out all of the driving motors. Such delays are very costly to the cotton textile industry where each process depends on the preceding one. Thus the company has not only managed to get its power cheaper, but it has also acquired much better operation of all of the mills and hence greater manufacturing economy.

EDITOR'S NOTE: *Mr. Field was employed this past summer in the electrical department of the Proximity Manufacturing Company about whose plant this article was written.*

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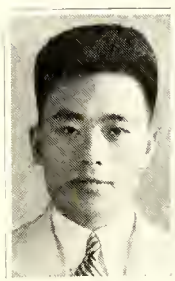


# Civil Engineering Progress in China

by TSU-YUAN KOO

EDITOR'S NOTE: Mr. Koo just came to America this fall and is a graduate student in sanitary engineering on a Rockefeller Foundation fellowship.

Far in the east lies the big old country, China, where civilization has existed for 4000 years, but where science has been very little known. Not until the beginning of the 19th century did China begin to realize her weaknesses, but since then she has been working hard and progressing steadily, though slowly, along engineering and scientific lines. Above all, civil engineering works are receiving more attention in China today.



## Road Work

After railroads, highways were started, and in the last two years almost 2000 miles of highways connecting up important places in the southern and central states of China have been completed. Several hundred thousand workmen are still busily engaged with building more and more roads.

On account of the lack of time and money, the construction of new railroads has not been urged recently, only two important lines of several hundred miles each being started in the last few years.

Much experimenting is being carried on now to determine the best kinds of pavements for highways and the best materials to use in railway building.

## River Work

There are two big rivers in China, one of which is named Yangtse Kiang, and the other, Hwang Ho. Yangtse Kiang is the fifth longest river in the world, and has a quite stable course and navigable channel which contributes greatly to the prosperity of the people along the river. Hwang Ho flows swiftly, and on account of its crooked course and sandy bank, it carries a heavy load of silt. Because of its muddy water, it has been given the name "Yellow River," or Hwang Ho. In places its bed is 20 ft. higher than the towns along the river, and if it should overtop the dikes, these towns would be entirely submerged. However, the high river bed has been taken advantage of by siphoning off the water for irrigation.

In 1931 the Yangtse River flooded its dikes, miles and miles of them being washed out and causing very heavy losses and a serious famine. The American wheat loaned to China at this time enabled the government to care for a million refu-

gees and to repair and strengthen the whole dike system in half a year's time.

Flood prevention is a big problem in China. The government spends several million dollars yearly to study and control the rivers all over the country. Most of the rivers in the south of China are quite deep with small slopes and not much fluctuation in flow, but the rivers in the north of China are entirely different. Because most of their sources are in the high mountains and because of the steepness of the barren valleys and the lack of upstream storage, they are usually practically dry except in flood seasons in the summer. Then, at places of contractions the rise in water may be as much as ten feet in half an hour. These fluctuations, together with the heavy silt burden carried along by the swift currents causes much trouble. Pending more permanent measures, efforts have been made to stabilize the deeper rivers with bank revetments and dike systems; while dams, reservoirs, silt detention basins, groins, dikes, diversion channels and channel straightenings have been studied and tried out on the rivers in northern China. An experimental laboratory has just been started for studying river regulation works with models.

## Surveying Work

Since 1920, both hydrological and geodetic surveys have been made in the important states with methods similar to those used by the United States Geodetic Survey parties. Harbor surveys at the proposed new eastern and northern ports are being conducted. Aeroplane survey, started two years ago, is used for quick mapping of lands under certain climatic and topographic conditions.

Meteorological records have been kept in observatories, and more and more rainfall gage stations are being established all over the country.

Soundings of the big Yangtse River and other important navigable channels have been undertaken by the customs offices and river bureaus. A maximum depth of 100 ft. and a maximum discharge of 2,500,000 cubic feet per second is recorded for the Yangtse Kiang.

## Sanitary Work

Sanitary engineering is quite new in China. Generally the people still hold to the old custom of drinking boiled waters and utilizing raw sewages for fertilizing purposes. But more and more water-purification and sewage-treatment plants are being built. Alum coagulation originated in China several hundred years ago, the people in

(Continued on page fifteen)

# ACTIVITIES OF THE SOCIETIES

## A. I. Ch. E.

The local student chapter of the A. I. Ch. E. held its first meeting of the fall quarter in October. An introductory program for the benefit of new members was presented. Pres. Richard Huber gave a talk on the history and scope of the student chapters of the Institute. Huber's talk preceded an address by Dr. White who defined and explained the nature of chemical engineering. At the conclusion of Dr. White's talk refreshments were served.

The Sophomore Award and a lecture by Dr. Ruark of the Physics Department were features of the second meeting on November 13. The A. I. Ch. E. award to the sophomore chemical engineer with the highest scholastic standing in his class for the preceding year was presented to William Priestly of Charlotte. Dr. Ruark lectured on the use of X-rays in the chemical industries. The use of X-rays in the identification of compounds was stressed. The lecture was illustrated with models. At the conclusion of Dr. Ruark's talk the meeting was adjourned.

## A. I. E. E.

The A. I. E. E. student chapter has held only one meeting thus far. Chairman Query introduced each of the new officers who were elected last spring. His introductions were accompanied with explanations of the duties attached to each office. Acting-Dean W. J. Miller, advisor of the chapter, was introduced and gave a short talk on the value of the national organization of the A. I. E. E. to its members. After a discussion of methods of utilizing surplus funds, a committee was appointed to settle the matter. The meeting was adjourned and refreshments were served in the electrical engineering laboratory.

On November 1 Dean Miller accompanied members of the senior and junior electrical classes to an afternoon session of the lighting sales course conducted by the General Electric Company at the Carolina Hotel in Raleigh. The most interesting lecture heard was presented by Mr. J. M. Ketch, commercial lighting engineer of Nela Park, Cleveland, Ohio, the location of the General Electric lighting laboratories. Mr. Ketch demonstrated his lecture with experiments and slides. The great future for the lighting industry and the fundamentals of interior and exterior lighting architecture were discussed.

A joint meeting of the chapters of Duke, N. C. State, and U. N. C. was held at Duke on November 7. A Talk on, "Power Transmission in England as Observed by a Student," was delivered by a Duke student. Dr. P. V. Faragher of the Aluminum Co. of America gave a technical talk on, "Aluminum and its Newer Applications." The session was concluded with a banquet that night.

Preparations for the presentation of student papers at the annual meeting of the Southern district of the A. I. E. E. at V. P. I. are urged by Dean Miller. Last spring Bill Ridenhour won third place with a paper on, "Public Utility Regulation in the South."

## TAU BETA PI

The North Carolina Beta chapter of Tau Beta Pi held its annual fall tapping on November 15 in Gerrard Hall. Dr. E. W. Zimmerman, of the commerce school was the guest speaker and spoke on "The Value of Economics to the Engineer." Following Dr. Zimmerman's talk the following men were tapped into the society; W. S. Harney and W. H. McNairy, seniors; and R. M. Neel, E. E. Eutsler, and H. J. Allison, juniors. To have been eligible for election these men had to have a scholastic standing in the upper fourth of the senior class or the upper eighth of the junior class.

The society also had a banquet earlier in the quarter at which time President Jack Crutchfield reported on the national convention which he attended in New York in October.

## A. S. C. E.

The student chapter of the A. S. C. E. held its first meeting of the year on October 11. At this time President W. H. McNairy made a few introductory remarks and presented the new officers to the society. Other officers besides Mr. McNairy are as follows: W. W. King, vice-president; W. C. Morrison, secretary; and J. A. Westbrook, treasurer. Professor T. F. Hickerson, faculty adviser, also gave a brief account of his trip last summer which he took to the Pacific coast and back through the Panama Canal.

Major Panton, of the water resources and engineering division of the Department of Conservation, addressed the second meeting of the society. He discussed conservation development in North Carolina.





The senior members of the society went on an inspection trip under the supervision of T. P. Noe, instructor in Steel Design. They inspected the plant of the Carolina Steel and Iron Company in Greensboro.

#### A. S. M. E.

The American Society of Mechanical Engineers have held three meetings this fall. At the first meeting President L. S. Tracy discussed the aims,



purposes, and activities of the Society, and invited all mechanical engineering students to join. Mr. E. G. Hoefer and Mr. Carmichael, of the Mechanical Engineering Department, made short talks. Mr. Carmichael, who has had considerable experience in ship building in England, chose for his subject, "The Construction of Ocean Liners."

At the second meeting a program committee composed of Tom Wilson and Hal Robbins was selected to assist J. M. Rennie, chairman of the entertainment committee. After the business of the meeting was completed, a paper was read by President L. S. Tracy on "The Autogiro." Also, a very interesting talk was made by Mr. J. A. MacLean, of the Mechanical Department, on "The Slotted Wing." He discussed the history of its development, mechanical details, and its possibilities.

On November 6 the society attended a joint meeting of all the N. C. Student Branches of the A. S. M. E. in Raleigh. About eighteen members made the trip and were entertained by an illustrated lecture on "Aluminum and Aluminum Products" by Dr. Faragher.

#### RECEPTION AT VENABLE HALL

An enjoyable reception was given in Venable Hall on October 15 by the chemistry department and Alpha Chi Sigma, chemical fraternity, for all students specializing in chemistry. The gathering, the first of its kind this year, succeeded in its purpose of bringing together the students from all fields of chemistry.

Dr. Bost acted as master of ceremonies. With numerous wisecracks he introduced in turn Walter Bateman, president of Alpha Chi Sigma, Dr. Wheeler, Dr. Cameron, and the professors who have recently come to the chemistry department. The professors caught the spirit and soon the group was in hilarious uproar.

Walter Bateman opened the program with one of his usual jokes which was told later in a different way by Dr. Cameron. That chased most of the lingering dignity, and nobody was afraid to laugh after that. Dr. Cameron told of his recent trip to the meeting of the American

Chemical Society in Cleveland, Ohio. Dr. Wheeler dwelt on the necessity for the students of chemistry to study mathematics, German, physics, geology, etc. as well as chemistry.

#### ENGINEERING IN CHINA

*(Continued from page thirteen)*

small towns and villages using it for water purification in home kitchens by applying some alum to water, and settling out the impurities overnight before boiling.

More attention is now being paid to the rural sanitation work, and the National Health Administration of the Central Government is training sanitary inspectors to improve both municipal and rural sanitation in the country.

#### Engineering Work of Old China

Besides all the new improvements, some of the old engineering works in China are quite valuable and worth mentioning. The famous Great Wall, built of bricks 2 ft. by 1 ft. by 6 inches, was constructed through the high mountains three thousand years ago for national defense at that time. Next to the Great Wall the long Canal was excavated for transportation across the country from the southern states to the former capital in the north. In addition to these two great works, many big-span and high-arch bridges with nearly a thousand year's history are still in existence.

#### American Engineers in China

In the past, two famous American engineers have worked in China. One was the late hydraulic engineer, Mr. John R. Freeman, and the other was the bridge expert, Dr. J. A. L. Waddell. Mr. Freeman went to China 15 years ago, and spent two years there studying the notorious Yellow River and the shallow Canal. Dr. Waddell was invited by the Chinese government for advices on the railroad bridges in 1929. Although neither of these men stayed in China long enough to complete much actual construction, they left their ideas, and opened the way for the Chinese engineers.

At present the Chinese Government engages Mr. G. G. Stroebe in the surveying department of the Yangtse River Commission, Mr. Brian R. Dyer (loaned by the Rockefeller Foundation) in the sanitary engineering department of the Health Administration, and Dr. Chatley in the Hwangpao River Conservancy Board. Besides these engineers there are many others working under the government or with private firms in many parts of the country. Mr. O. J. Todd, chief engineer of the International Famine Relief Commission in China, went to China with Mr. Freeman, and stayed there longer, probably, than any of the other American engineers.

# E - D - I - T - O - R - I - A - L

## ENGINEERING CONSOLIDATION

Since the first mention of the consolidation of the Greater University of North Carolina, it has been rumored that the engineering school at Chapel Hill will be moved to Raleigh. However, quite contrary to public opinion, the committee on consolidation made a different recommendation. In fact, it recommended an ultimate consolidation of engineering training at Chapel Hill. In considering the idea as held by popular opinion the committee had this to say:

"... If only the engineering school at Chapel Hill were to be transferred without other measures to strengthen the organization at Raleigh, the immediate result might be little more than a relocation of the portable equipment. Much of the best research equipment for hydraulic and sanitary engineering is of fixed character and would remain in Chapel Hill. It seems highly probable that the present engineering staff and student body at Chapel Hill would be scattered among the other institutions. The Southeast would thus lose its only existing center of post-graduate work in engineering on a genuinely advanced level, . . ."

In recommending a policy to be carried out for consolidation of engineering schools, the committee's fourth and recommended plan was:

"4. To adopt as a policy the ultimate consolidation of all scientific and technical divisions, except at the junior-college level, at Chapel Hill . . . Within the financial resources of the state, it is felt that no other plan can assure the best in scientific and technological education, and this is the plan that is recommended."

"... Consolidation on the lines suggested in the last plan is believed to offer North Carolina an unequalled opportunity, in view of the present division of educational forces in all the neighboring states."

In making the recommendation the committee, composed of men prominent in educational work, was certainly not influenced by political factions, nor swayed by public opinion. Their work represents a conscientious investigation, and their suggestions were made after months of thorough study.

However, the general public has been unaware of the report of the consolidation committee and, having heard of engineering at our sister institution, has assumed that it should be concentrated there. At the same time the advantages of the consolidation committee's plan are readily apparent. The foundation of engineering training

lies in the basic sciences, mathematics, chemistry, and physics. The local departments of these sciences have long received national recognition in their respective fields. The importance of these basic sciences can not be over-emphasized in the young engineer's training. In fact, one man, a former personnel director for a large industrial concern, in making an address here said that a knowledge of mathematics and physics and the ability to use a monkey wrench were the essential requirements for the young man entering the engineering profession.

Then, too, engineering is becoming more intimately connected with law, economics, and psychology, which are better centered in a university than in a distinctly technical school. This broadening of the engineering curriculum has been necessary because of the new place of the engineer in the industrial world. The engineer is no longer an expert technician alone but is fast becoming a director and organizer. This new position requires of the engineer not only excellent technical training but also a well-rounded education best secured under the cultural and broadening influence of a university.

In an editorial on July 13, 1932, the Raleigh, N. C. *News and Observer* discussed the report made to the joint Board of Trustees of the consolidated University of North Carolina by Dr. George A. Works, Chairman of the Survey Committee on Consolidation. Relative to a statement by Dr. Works in reference to the rating of the School of Engineering of the University at Chapel Hill, the editorial commented as follows:

"It has broadened its course until today it is recognized, as Dr. Works said, as having the best school of engineering in the South, and its chemical department has long been placed among the best in the country. It has long been given first place among Southern Universities."

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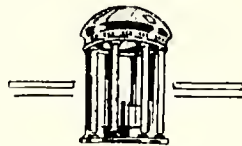
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